connection will appreciate the advantage of making the distinction. It is, however, to be regretted that in the matter of notation the author is too intensely German. He puts P for force, A for energy, L for power, D for torque, and so on, all letters which have internationally already a significance. The reader is thus put unnecessarily to the trouble and mental strain to substitute for symbols he is accustomed to use (and which, to a certain degree, have already received the sanction of the International Electrotechnical Commission) others which are unfamiliar to him.

It is not necessary to enumerate the contents of this book in detail; suffice it to say that it broadly covers the subject of laboratory tests such as are necessary for students. As to the question of which tests are necessary and which may be omitted, opinions will always differ. It would be easy to give a list of tests which, in the reviewer's opinion, ought to have been included, but such criticism would hardly be fair, for a book on testing cannot contain every possible test, but only a selection of those which the author himself has found suitable. On the whole, the author has given us a very representative and useful selection, covering a wide field. His book will be found to be a most helpful guide to electrical laboratory work generally. GISBERT KAPP.

ANCIENT HINDU CHEMISTRY.

A History of Hindu Chemistry from the Earliest Times to the Middle of the Sixteenth Century A.D., with Sanskrit Texts, &c. By Prof. Praphulla Chandra Ray. Vol. ii. Pp. xcvi+293+152+xxi. (Calcutta: The Bengal Chemical and Pharmaceutical Works, Ltd.; London: Williams and Norgate, 1909.) Price 10*s.* 6*d.* net.

IN the first volume of this book, which was published in 1902, and reviewed in these columns on May 21, 1903, Prof. Ray dealt with all the oldest (pre-Buddha) Hindu MSS., and many of the later ones. A number of MSS. remained untouched, and now that these have been examined, the concluding volume has been issued. It has been a labour of love which has occupied all Prof. Ray's spare time for the last fifteen years, and the great value of the results of his patient and laborious researches will be fully appreciated by all students of the history of chemistry.

The difficulties of determining the extent of Indian chemical lore in ancient times are profound. There is no doubt that at a very early period the Arians attained great proficiency in the manufacturing industries, which must have rested on a good practical knowledge of chemical reactions. The famous sword-blades, called by the Greeks "marvellous swords," and by the Western world "Damascened blades," were brought to Europe by way of Damascus, but were made in India. The making and polishing of glass in India, including lenses and mirrors of various kinds, spherical, oval, &c., was a well-known industry. Pliny mentions that the best glass ever made was Indian glass. In pharmacy, in dyeing, in the manufacture of perfumery and cosmetics, complicated chemical operations must have been carried out even before the time of Buddha, which is placed about B.C. 500.

There is, however, little or no trace of these things in the literature of the period. The caste system was radically opposed to the formation of a science in which practice is based on theory. The chemical industries were exercised by a despised caste, that of the *cudras*, and their labours were no doubt deemed unworthy of being described by the caste of the *Brahmins*, or priests, who alone understood the art of writing. Thus Hoefer, for example, remarks that amongst the Sanskrit manuscripts in the Bibliothèque Imperiale, of Paris, no document occurs which can be of interest to the historian of chemistry, and Berthelot in his "Origines de l'Alchemie" practically ignores India.

The MSS. patiently examined by Prof. Ray appear to consist largely of religious or philosophical reflections, with occasional somewhat obscure references to chemical subjects made for the purpose of illustration. Thus in a document called "Rasaratnakara," written by Nagarjuna, who was the High Priest of Buddha about A.D. 150, such texts as the following occur:—

"What wonder is it that cinnabar digested several times with the milk of the ewe and the [vegetable] acids imparts to silver the lustre of gold glowing as saffron?"

And a little further on:—

"Silver alloyed with lead and fused with ashes becomes purified,"

which is a clear allusion to cupellation.

It is probable that the pundits, when referring to metal-working, often knew very little of the subjects they mentioned, but Nagarjuna was celebrated as an alchemist. Prof. Ray argues at some length in favour of the indigenous origin of Indian alchemy, and, however degrading it may have been to work, it does not appear to have been derogatory to the dignity of the sages to discuss the manufacture of gold or silver. Thus—

"Tin is to be melted and one-hundredth part its weight of mercury to be amalgamated with it. This [fraudulent substitute for] silver can be used for purposes of exchange, and one can thus amass wealth."

The last 150 pages of the book consist of a reproduction of original Sanskrit texts, taken from many different MSS. T. K. R.

AN ENCYCLOPÆDIA OF THE SCIENCES.

Instruments optiques d'Observation et de Mesure. By Jules Raibaud. Pp. 380. (Paris: O. Doin et Fils, 1909.) Price 5 francs.

THIS volume is a unit in a somewhat extensive undertaking, no less than an encyclopædia of all the sciences, pure and applied, physical and biological, material, mental, and moral. The scheme is of a somewhat novel character; its magnitude may be judged from the fact that it involves a total of some thousand volumes, arranged in forty sections or "bibliothèques," the whole to rival, we are told, the largest encyclopædias of this or any other country—and not only in size. The novelty lies mainly in the fact that each volume is to be independent, and have its own individuality; each will be a monograph dealing with a special branch of the particular section to which it belongs. The size and price will be uniform, the number of pages approximately so. One

among the advantages of the scheme will be that each volume can be brought up to date independently of the rest.

The forty sections are classified in the two main divisions of "pure sciences" and "applied sciences." Each of these is again subdivided into mathematical, inorganic, and biological sciences. Each subdivision comprises a certain number of sections, and each section has its own editor. The general editor is Dr. Toulouse, of the Ecole des Hautes Études, and among the editors of sections are included such names as Painlevé, Mascart, Leduc, Lacroix, Bertrand.

The volume under review belongs to the section of "Industries physiques" in the division of applied sciences—subdivision, inorganic. The section is to include volumes on such subjects as "Industrial Electricity" (two vols.), "Electric Motors," "Electric Traction," "Electric Lighting," "Rheostats," "Wireless Telegraphy," "The Liquefaction of Gases," "The Industrial Production of High Temperatures," &c. This volume on "Optical Instruments for Observation and for Measurement" would seem to be the first volume of the section to be issued.

Judged from its position in this hierarchy of scientific knowledge, Captain Raibaud's volume is perhaps a little disappointing. One might expect to find details of the most recent technical advances, of such a character that the skilled optician might there find help, whether as regards difficulties of design, or of construction, or methods of ensuring accuracy. In the present instance, however, questions not only as to calculation of the optical system, but as to construction and methods of test, are definitely excluded; the aim is thus only to give a general account of the optical properties of various types of instrument, with brief particulars of individual instruments and designs. Expressed shortly, the work is rather an educational text-book than a technical handbook.

From this point of view, however, and for the general reader who wishes to obtain an intelligent knowledge of the more essential optical properties and possible defects of an instrument which he may be in the habit of using, the book can be cordially recommended. More especially, the general conditions governing the formation of satisfactory images by an optical instrument are carefully and clearly discussed. Thus the first part of the work, more than one-third of the whole, deals with the general properties of instruments, definition and resolving power, brightness of the image, extent of field of view in breadth and depth, distortion, magnification—subordinate, as is rightly emphasised, to resolving power and definition—and the functions and limitations of the eye in conjunction with an optical instrument. The characteristics of binocular vision and of vision through a binocular instrument are also examined, and, in regard to measuring instruments, the general conditions affecting accuracy.

In the second part of the book the instruments considered are those of the telescope class, the microscope, the photographic objective, instruments for measuring angles, surveying instruments and telemeters, and, finally, instruments based on the principle of auto-collimation. The list, of course, is by no means exhaustive; laboratory instruments, the spectroscope, interferometer, &c., and photometric apparatus generally are not included, nor does space admit of detailed consideration of any one type. The book is, however, written by one who has had experience in handling the instruments he describes, and thoroughly familiar, not only with the optical theory, but also with the practical points affecting their performance.

OUR BOOK SHELF.

Methods used in the Examination of Milk and Dairy Products. By Dr. Chr. Barthel. Translation by W. Goodwin. Pp. xii+260. (London: Macmillan and Co., Ltd., 1910.) Price 7*s.* 6*d.* net.

THIS edition contains several additions to the original work of Dr. Barthel, and it will be found very useful to those engaged in examining milk and dairy products on a large scale. The general remarks in it apply more exactly to milk of German or Swedish origin than to milk from some British breeds of cows.

In the notes on the physical examination of milk are useful hints as to the estimation of dirt. For the determination of fat Soxhlet's aræometer method is still given a prominent place, though in most places it is superseded by less complicated and more certain methods. Wollny's refractometer method for the fat estimation, if carried out under exact conditions, seems to give very accurate results, but it is so sensitive that the least departure from the necessary conditions influences the results seriously; one advantage it possesses is that as many as 150 determinations may be made in an hour with the proper appliances and accommodation. The Rose-Gottlieb method, and various modifications of centrifuge methods, including some not requiring the use of strong sulphuric acid, are described. Tests for adulterations, artificial colouring matters, and preservatives are given. Saccharate of lime is said to be one of the latest adulterations of milk and cream; it increases their viscosity and gives them the appearance of being richer in fat; a method for its detection is given.

Methods for the analysis of butter, cheese, preserved milk—including Buddised milk, that is, milk treated with a small quantity of hydrogen peroxide—condensed milk, and desiccated milk are given. We find also some account of the decomposition products of milk, butter, and cheese; and, in an appendix, several tables of figures useful in calculating the results of analyses.

Norwegian and Other Fish Tales. By Bradnock Hall. Pp. x+243. (London: Smith, Elder and Co., 1910.) Price 5*s.* net.

THIS is a frankly trivial book with a quite unintelligible dedication in place of a preface. The illustrations are excellent, and the text makes good holiday reading, notwithstanding its somewhat strained humour. As the author says, "the diaries of anglers are not as a rule interesting, even to sympathetic brethren of the craft," but we think that many of the author's own experiences at least come near to proving exceptions to his own generalisation. Incidentally, we are told of certain Norwegian fish:—"Everyone thought they were salmon, but both turned out to be sea-trout when the shape of the gill covers and the tail bones were examined." It seems a pity that the precise differences between salmon and sea-trout in the shape of the gill covers and tail bones are not divulged for the benefit of fishermen and naturalists; the counting of scales in a transverse series is none too easy, and an alternative method of diagnosis (if such really exists) would be welcome.